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MOTHS AND THEIR CLASSIFICATION.

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Probably no group of animals has suffered so much at the hands of unscientific systematists as the Lepidoptera, and the reason of this is not far to seek. It is directly attributable to the great range of colour and variety of marking which are so striking a characteristic of the group, instantly attracting the attention of the superficial student, and causing him to neglect structural details as unnecessary, or even to intentionally reject them as contradicting the testimony of colour, and therefore untrustworthy. Allied species, he argues, are usually similar in colouring; therefore similar species are allied; which, however, does not follow.

It is true that this theory is now seldom put forward in a simple and unadulterated form. Dr. von Gumppenberg, indeed, has lately issued an elaborate monograph of Geometers, in which all structural investigations are cast to the winds, and the genera defined solely by colour and marking, but it does not seem to have been warmly received. But in a modified form the theory is still so extremely popular that it exercises considerable influence over the views of almost all lepidopterists. This modification consists in classifying species by superficial appearance in the first instance, and then trying to find structural excuses for it afterwards. No better example of the consistent working of this method can be found than in the works of Guenée. In the six volumes which he contributed to the 'Species Général des Lépidoptères,' I cannot recall a single instance in which he has suffered structural characters to override superficial; and yet each genus and family is prefaced by a careful statement of structural points which may readily, nay, is almost certain to be mistaken for a diagnosis, until one tries to work with it. For example, in characterizing his Geometrid family *Acidalidæ*, he correctly states "indépendante bien marquée aux quatre ailes; costale des inférieures isolée de la sous-costale ou simplement rapprochée," of which the equivalent in my terminology would be "vein 5 well-developed, 8 in the hind wings not connected with cell or near base only," which are really essential characters of his genus *Acidalia* and its allies, and no exceptions are mentioned. Moreover, if the characters given for the *Acidalidæ* and the *Larentidæ*, for instance, are compared throughout, it will be seen that there is no absolute distinction between them except in the latter of these two characters, the corresponding point for the *Larentidæ* being "costale des secondes ailes presque toujours bifide," that is, "8 in the hind wings anastomosing with cell to beyond middle." Now if we proceed to examine the genera attributed to the *Acidalidæ*, we find the first, *Synegia*, really has 5 in the hind wings obsolete, and should therefore be placed (not only correctly, but on Guenée's own definition) in his family *Boarmidæ;* the second, *Drapetodes*, is not a Geometer at all, but belongs to the *Drepanidæ*, having 5 approximated to 4 in both wings; the fifth, *Pomasia*, and the seventh to tenth, *Cambogia*, *Asthena*, *Eupisteria*, *Venusia*, all have 8 in the hind wings anastomosing strongly with the cell, and belong in truth to the *Larentidæ*. The family definition has in fact been disregarded altogether. On the other hand, the characters given for the *Apamidæ* and *Hadenidæ*, for instance, have little reference to structure, and are practically identical; hence it is not surprising that species rightly referable to the same genus are placed by Guenée, some in one and some in the other of these two families, which are separated from one another by four other considerable families of *Noctuæ*. Now these are not isolated instances, but fairly typical examples of the whole work; and yet this classification, having been adopted by both Doubleday and Stainton, has held the field in Britain for forty years, and has become so

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familiar that to most British entomologists all deviations from it seem artificial and unnatural.

In a sound system of classification the various groups must be capable of actual diagnostic definition in words, or the system is unworkable; they must be defined by structure, or it is misleading; and the system must be based on the study of the phylogeny (or scheme of ancestral descent), or it is artificial. Of late years some progress has been made in classifying the Lepidoptera in accordance with these principles, and as the general lines of such a classification are now fairly well established, it may be of interest to give a sketch of the results already reached, as illustrating principles of universal application.

Four-winged insects usually have some contrivance for holding together the two wings on one side, and ensuring their common action. Thus in the Hymenoptera (bees, &c.) there is a row of hooks and eyes; in the Trichoptera (caddis-flies) there is a membranous process (jugum) from the dorsum of the fore wings near the base, which projects beneath the edge of the hind wings, whilst the following part of the dorsum extends above it; again in the Lepidoptera there is normally a stout bristle or group of bristles (frenulum) rising from the edge of the hind wings near the base, and passing under a catch on the under side of the fore wings. Some Lepidoptera do not possess this frenulum, and in such cases the basal angle of the hind wings is made more prominent so as to project beneath the base of the fore wings and prevent dislocation. But some five years ago Prof. Comstock made the discovery that in two families, the *Hepialidæ* and the *Micropterygidæ*, instead of the usual lepidopterous structure, there is a jugum, quite as in the Trichoptera. There is no difficulty in seeing this structure, at any rate in the *Hepialidæ*, some of which are very large insects of five or six inches expanse of wing, and it remained undiscovered so long simply because no one had thought of looking for it; a striking instance of the ease with which characters of the highest importance can be overlooked by competent observers, unless their attention is specially directed towards them. Now it was known previously that these same two families agree together in possessing several additional veins in the hind wings, which are not found in any other Lepidoptera; these veins could not have been evolved from nonexistent structures, and are therefore ancestral; hence these two families constitute not only a separate group, but the oldest group of the Lepidoptera, and may be termed *Micropterygina.* Their close affinity to the Trichoptera is shown by the possession of the jugum, and by the fact that the complex neuration of the *Micropterygidæ* is practically quite identical with that of certain Trichoptera (as *Rhyacophila*). As the Trichoptera usually possess a much larger number of veins, especially in the hind wings, they must be the older group, and the Lepidoptera must have originated from them. The most ancient *Micropterygidæ* known are found in New Zealand, though the majority are European; but these little insects are so readily overlooked by collectors that their distribution is insufficiently ascertained. The *Hepialidæ,* standing considerably isolated from these, are presumably the highest development of a once extensive group, intermediate forms being apparently all extinct; they are now very widely distributed, probably as a result of their very powerful flight, but would seem to be Indo-Malayan in origin.

The next point is to ascertain the connection of the typical Lepidoptera with the *Micropterygina;* this cannot be at more than one point, since it is highly improbable that the frenulum and fixed type of lepidopterous neuration could have been evolved twice. This transition is undoubtedly indicated by the New Zealand genus *Mnesarchæa,* which in the character of the palpi and the neuration of fore wings approximates closely to some forms of *Plutellidæ* and *Tineidæ,* whilst remaining by strict definition a true Micropterygid. The origin of the *Tineina* is thus established; and in the two above-mentioned earliest families (divergent branches from the same stem) the excessively long antennæ of the *Adela* group, and the occurrence of long six-jointed maxillary palpi in many genera of the *Tineidæ,* as also the porrected habit of the antennæ in some genera of *Plutellidæ,* are distinct reminiscences of their Trichopterous origin, and may be quoted as examples of reversion. Further, there can be no question that the other families of the *Tineina* constitute a line of development originating in the *Plutellidæ,* all these being typically smooth-headed; whilst the *Tortricina* form a parallel branch taking its rise from the *Tineidæ,* all these being typically rough-headed. Whether the *Tortricina* are maintained as a separate group, as has usually been done, or, in accordance with the views of Lord Walsingham and Mr. Durrant, merged in the *Tineina*, is only a question of name and convenience, and therefore of no marked importance. It should be noted that in all the families of these groups there are normally three free veins (1*a*, 1*b*, 1*c*) between the cell and dorsum in the hind wings, though in cases where the area of wing is very small, as in some of the minute *Tineina*, these and most of the other veins are liable to disappear.

Here may be considered two particular cases, those of the *Aegeriadæ* and *Trypanidæ*. The *Aegeriadæ*, popularly known as "clear-wings" from the hyaline spaces on their wings, used formerly to be oddly placed near the *Sphingidæ*, but are in all essential characters undoubted *Tineina*, parallel in development with the *Gelechiadæ* and *Oecophoridæ*. The *Trypanidæ* (*Cossidæ* of some) must be regarded as unspecialized *Tortricina*, marking the transition from the *Tineidæ;* the comparatively gigantic size of the single British species is at first sight somewhat startling, but this is not always maintained in exotic forms, and there is really no other distinction at all. The wood-feeding habit of the larva is very characteristic of that group of the *Tineidæ* from which it is derived.

Having now established in the *Tineina* a base of origin, with which the connection of the general body of Lepidoptera has to be traced, we may consider what characters can be held to indicate nearness to or remoteness from this base. The best indication for this purpose will be furnished by the presence or loss of some ancestral character which when once lost is incapable of redevelopment. Prof. Comstock has employed the frenulum for this, but the choice appears to be unfortunate, for three reasons, *viz.* (1) the proportion separable as having lost the frenulum is comparatively small; (2) the frenulum may have been lost in different groups quite independently, and has in fact obviously been so lost in several families; (3) as the frenulum is apparently only the modification of hairs which are always present, there seems no reason why it might not exceptionally be redeveloped by reversion. A better character is furnished by the presence or absence of vein 1*c* in the hind wings, which is found to be usually constant not only in families, but in main groups, and a vein once lost can never be regained; but of course the loss may have, and apparently has, taken place independently in more than one line of descent. The whole of the remaining Lepidoptera may then be classed in two groups (*Psychina* and *Pyralidina*) which normally retain this vein, and four others which have entirely lost it.

The *Psychina* are a group of families of unspecialized type, which in fact approach the *Tineina* so closely as not to be separable as a whole by any single character, though each family considered by itself is so separable; at the same time the four families composing it are nearly related together in their lowest forms, and may therefore be regarded as parallel developments. Even the markings of the wings show this want of specialization, as they are, when present, irregular and without definite type of arrangement, and all the families show a marked tendency (in the *Psychidæ* becoming a fixed character) to produce thinly-scaled or semi-hyaline unicolorous forms. It is probable that this indicates approximate relationship to the *Fumea* group of the *Tineidæ*, to which the *Psychidæ* also display their affinity by their apterous females and the case-bearing habit of the larva; on this ground they have even been included together in the same family, but the true *Psychidæ* are always distinguished by the anastomosing subdorsal veins of the fore wings. The *Zygænidæ* include many large butterfly-like forms, brilliantly coloured with metallic blue, crimson, and white; the short, stout, often tuberculated and rather hairy larvæ are of an early type, and though apparently very different in form and habits to the *Psychidæ*, both are probably the modified descendants of internal wood-feeders. The *Heterogeneidæ* (*Limacodidæ* of some) are remarkable for their larvæ, which are an exaggeration of the Zygænid type, the legs being often very short and retractile, so that the larva appears to be appressed to the leaf like a slug, whilst the dorsal tubercles are often developed into clusters of stinging spines; and for the small hard oval cocoons, which open by a lid. The tibial spurs of the imago are long, as in the *Tineina* generally, whilst in the allied families they are very short or absent, but there is here probably some connection with bulk or weight. Finally, the *Zeuzeridæ*, whilst structurally related to the *Psychidæ*, show by the wood-feeding habit of their larvæ and other characters collateral affinity with the *Trypanidæ*, traceable to their common descent. The rather confusing cross-relationships between these several families are characteristic of little-specialized forms; it is as if one had to disentangle a network of small divaricating twigs close to the stem, whilst the course of the larger branches is comparatively easy to trace.

The *Pyralidina* are commonly distinguishable from the other groups already mentioned by the structure of vein 8 of the hind wings, which is brought down so as to closely approach or anastomose with vein 7 beyond the cell. Another character almost constant throughout the group is the stalking of veins 8 and 9 of the fore wings; it is quite constant in most of the families, but in the mainly tropical family *Thyrididæ* these veins are more usually separate; we may therefore with considerable probability regard the *Thyrididæ* as ancestral. Finding further that they nearly approach the *Heterogeneidæ*, both structurally and superficially, whilst the other families are of a peculiar type which is remote from anything else, we shall be justified in looking to the *Heterogeneidæ* as the origin of the group. The mutual relations of the nine families composing this extensive division need not be discussed here in the main; but the case of the *Pterophoridæ* may be mentioned. These curious insects, the well-known "plume-moths," usually have the wings very narrow, and split into two or three feather-like lobes; hence the neuration tends to be much degraded for want of room, but in the earliest forms (and recognizing the transition afforded by the small Australian family *Tineodidæ*) it approaches the Pyralid type; with which also the unusually long and slender legs, the structure of the head, and the larval appearance and habits are also in accordance. The *Orneodidæ* (in which each wing is split into six plumes) can be traced to the same source.

Coming now to the groups which have vein 1*c* of the hind wings constantly absent, it will be convenient to study first the *Papilionina*, generally termed "butterflies." Notwithstanding the amount of attention bestowed on this attractive group, little has been written as to its origin. It is characterized by the clubbed antennæ, and absence of the frenulum, both these features being found in other cases but not in combination. As it falls into two sections, of which one (*Hesperiadæ*) has all the veins of the fore wings separate, and the median spurs of the posterior tibiæ usually present, whilst the other has always two or more veins stalked, and the said spurs always absent, there can be no doubt that the *Hesperiadæ* are the most ancestral family. Their very simple neuration closely resembles that of the *Thyrididæ*, but is not found elsewhere in the higher groups, and there is no discordance in other structural characters; moreover, the tendency to show pale semi-hyaline spots in the fore wings, and the development of specific colour-characters on the lower surface of the hind wings, are marked points of superficial resemblance. Similarly knobbed antennæ occurring in the higher *Caradrinina* (*Agaristidæ*) have been thought to indicate relationship to the *Papilionina;* but there the frenulum is always strong and persistent, and the required simple type of neuration is never found. Hence we must suppose that the *Thyrididæ* are the true starting-point of the group.

The *Lasiocampina* comprise five families of no great extent altogether. In these the frenulum either is or tends to be absent, and vein 8 of the hind wings is frequently approximated to 7 beyond the cell, the group being always separable from the *Caradrinina* by one or other of these characters. In the *Pterothysanidæ*, *Lasiocampidæ*, and *Endromididæ* the frenulum is constantly absent; in the *Drepanidæ* and *Callidulidæ* it is sometimes present, though tending towards obsolescence, and these two families, which are apparently collateral developments, must be the more primitive. They approach the *Thyrididæ*, and the *Callidulidæ* also appear to show near collateral relationship to the *Papilionina*, for which, except that the antennæ are not knobbed, they might sometimes be mistaken even by an expert.

The *Notodontina* include all those families of the higher Lepidoptera in which vein 5 of the fore wings, instead of being approximated at its origin to 4, is parallel with it, or even sometimes more approximated to 6, thus appearing to form an independent vein from the cell, instead of a branch of the vein which forms the lower margin of the cell. There is no reason to suspect that this modification has arisen more than once, the whole of these families agreeing well together in all other respects. The *Eupterotidæ*, mostly large insects which, both in the imago and larva states, have considerable relationship to the *Lasio-*

campidæ, are probably the least specialized; as they possess a frenulum, they cannot justly be derived from the *Lasiocampidæ* themselves, but have probably a common ancestor not far removed. From this original family are derived four branches, *viz.* (1) the *Bombycidæ* (this name has often been wrongly applied to the *Lasiocampidæ*, but here denotes *Bombyx mori*, the "silk-worm" moth, and its allies) and *Saturniadæ*, which have lost the frenulum entirely; (2) the *Notodontidæ*, *Polyplocidæ* (*Cymatophoridæ* of some), and *Sphingidæ*, stout-bodied forms, whose larvæ are commonly furnished with various prominences; (3) the *Uraniadæ* and *Epiplemidæ*, in which veins 6 and 7 of the fore wings are normally stalked; (4) the several families formerly called *Geometrina*, whose larvæ have usually lost two or three pairs of prolegs.

Lastly, the *Caradrinina* contain seven families, of which the *Ocneriadæ* (*Liparidæ* of some) is doubtless the most ancestral, making in fact a close approximation in many points to the *Psychidæ*, and showing a tendency to exhibit similar apterous females. In this, and the allied family *Hypsidæ*, vein 8 of the hind wings is connected by a bar with the middle of the upper margin of the cell. In the *Agaristidæ*, *Caradrinidæ*, and *Plusiadæ* (these two latter forming the old group *Noctuæ*, whose name is untenable, belonging by right of priority to an owl), this is modified so that 8 anastomoses with the cell-margin very shortly near base, the *Agaristidæ* being characterized by the apically swollen or sometimes clubbed antennæ, the *Caradrinidæ* by the obsolescence of vein 8 in the hind wings, which in the *Plusiadæ* is well-developed. In the *Arctiadæ* a further modification takes place, 8 anastomosing with the cell-margin for a considerable distance from base. In the *Syntomididæ* is reached the extreme of change in this direction, 8 becoming wholly absent by coincidence with the cell-margin and 7.

In this scheme the *Caradrinina*, *Notodontina*, *Papilionina*, and *Tortricina* are all terminal developments, *i. e.* growths which lead to nothing beyond themselves, and in translating this scheme into a linear form it would be possible to take any one of these as top, and the other branches in any convenient succession. But, considered as a whole, the *Caradrinina*, from the difficulty of sharply defining the families (which implies comparatively little extinction), and their dominant character, as shown by their wide distribution and the prodigious number of similar species and individuals, must be thought to be the most recent. The following order correctly expresses the phylogeny as indicated above, whilst paying some regard to collateral relationship also, viz. **Caradrinina*, **Notodontina*, *Lasiocampina*, **Papilionina*, *Pyralidina*, *Psychina*, ** Tortricina*, *Tineina*, *Micropterygina;* where the asterisk marks terminal developments.

It is not uncommon to see futile discussions as to which of two groups, reached by different lines of descent, is the higher, *i.e.* the more highly organized. The question is not only always unanswerable, but the answer would be quite valueless if found; all that can be done is to find the more recent.

In conclusion, a word as to the practical value of structural characters in classification. Characters of colour and general form are bad only because they are particularly liable to be modified by changes of environment. Now some structural characters are quite as liable, and are therefore equally bad. For example, in birds the shape of the beak is obviously likely to be modified in accordance with a change of food, and is therefore (as between allied forms) probably little better than a colour character. Yet the teeth of mammals, used for the same purpose, afford an excellent character, because the element of number comes in, which gives definition and admits of greater variation. It may be doubted whether any group of animals exhibits a better character than the neuration of insects, which displays sufficient complexity and variation in the number and interconnection of the different veins, whilst at the same time it is practically unaffected by external forces, except occasionally the easily calculable influence of a change in form of wing; moreover, the modifications effected are often irrevocable, and therefore less puzzling to follow.

THE MAMMALIA OF GREAT YARMOUTH AND ITS IMMEDIATE NEIGHBOURHOOD.

By Arthur Patterson.

Great Yarmouth, the second town in importance in Norfolk, and celebrated the world over for its Herring fishery and "bloater cure," stands on a peninsula; it is bounded on the east by the North Sea, and on the west by the River Yare, from which it derives its name. It is situated in lat. 52° 36′ 40″ north, and long. 1° 44′ 22″ east. From London it is 108 miles in a direct line, and south-east from Norwich nineteen miles "as the crow flies."

Southwards to Lowestoft extends a long line of cliffs, averaging 30 ft. in height, "composed principally of disrupted crag, sand, and clay, beneath which has occasionally been laid bare a stratum of blue clay, the wreck of the Lias."* In these cliffs the remains of the Mammoth, and on one occasion the skull of a Beaver, have been met with.

Northward runs a long range of low sandhills, which, like the cliffs southwards, have been and are suffering severely from the encroachments of heavy tides; as recently as Nov. 29th, 1897, the sea broke through immediately north of Winterton, drowning a number of Rabbits on the warren. Owing to want of sufficient care in keeping up the sandhills, and encouraging the growth of the marrum grass (*Ammophila arundinacea*), *Agropyrum junceum*, the sand-sedge (*Carex arenaria*), all of which are indigenous to the locality, they are become no longer a sturdy barrier against the wild ravings of the rough North Sea. The North and South Denes are less conspicuous undulations of blown sand held together by the creeping roots of the rest-harrow (*Ononis spinus*), the sea-purslane (*Arenaria peploides*), and others. Within the past few years the furze, which came quite up to the town boundary upon the North Denes, has been all but exterminated, and the sand-dunes levelled for golfing and building purposes.

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* C. J. and James Paget, 'A Sketch of the Natural History of Great Yarmouth,' p. iv. 1834.

To the west of the town lies a great alluvial level, once the bed of the Garienis Ostium. Dyked and drained, this large area forms most valuable marshland, affording pasturage for many herds of cattle. The famous Broads are remains of this fine estuary. Breydon, another portion of it, five miles long and one in width, at the juncture of the Yare, Waveney, and Bure, remains a great salt-water tidal basin; its northern point reaches the town quays. "By the improved banking of the rivers" a large tract that was once under water has been reclaimed, and the drainage and cultivation following have, in the course of years, produced great changes in the natural productions of the district. The country a few miles northward becomes more hilly and wooded, as it does southward of Breydon. There is, however, nothing deserving of the name of a wood, except at Fritton, within the ten mile radius included in this paper.

Very pithily and concisely the Pagets (referring to the various classes of the local fauna) remark:—"In none of them have the changes described as taken place, in consequence of cultivation, been so much felt as in the Mammalia, nearly all of which, with the exception of the few species which it is a matter of profit to preserve, are either totally exterminated, or in rapid progress towards being so." To the few exceptions referred to may be added such as from their amazing fecundity, and the gradual extirpation of their natural enemies, are becoming a pest and a scourge to cultivation itself; the Field Vole and the Brown Rat are instances in proof. And so long as the lesser birds of prey and the Weasel family are so incessantly persecuted, will this evil continue and increase.

Lubbock* makes mention of a species of Dog—the black curly-coated Retriever—as "very common here, though not entirely peculiar to the county—the Yarmouth Water-Dog, as they are generally termed in other parts of England." The sagacity of this species is referred to in the case of one kept many years ago at a drainage mill adjoining Breydon. It regularly searched the flint-stone "walls" in winter for wounded wildfowl, which usually seek some nook or cranny. "When the wind was north-east, and many Ducks in the country,* he sometimes carried home eight or nine fowl of various kinds in the same morning." How he evaded scrutiny and interference, and picked up his trail after each home-going, are interesting matters of detail. An animal of the same breed was kept in the seventies by the late G. Overend, a famous collector of local birds; it exhibited some remarkable traits, fetching newspapers, and exchanging them with various friends of his master, and other notable things. It is still fairly common in the locality, but has been superseded by the Spaniel by the very few gunners who follow up shooting along the "walls" and on the marshes.

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* 'Fauna of Norfolk,' p. 4 in 1845 edition.

With regard to the species mentioned in the following list, our knowledge of the Chiroptera may be mentioned as yet being in an unsatisfactory state; but few sportsmen, save novices, ever trouble themselves to bring down such mean game; and, as their habits make observation an awkward and at best but a casual matter, one or two other species than those enumerated may really be frequenting the neighbourhood, but are as yet awaiting detection. Amongst the Insectivora, the "Oared Shrew" † has not yet been observed in the locality. All the *Mustelidæ*, with the exception perhaps of the Weasel, are yearly becoming scarcer. The *Phocidæ*, on the other hand, are more frequent in their visits. Opportunities for observing the Cetacea have always been and will remain difficult and casual. The Rodentia have become restricted, or have increased, according to the circumstances which affect their natural economy.

At present the list comprises the following:—1. Chiroptera (four). 2. Insectivora (four). 3. Carnivora and Pinnipedia (ten). 4. Rodentia (twelve). 5. Cetacea (eight). Of these two carnivores and one rodent are now extinct, one rodent may be referred to as a subspecies, and one *Phocidæ* as doubtful.

The first list of Yarmouth Mammalia was published in 1834 by the Brothers Paget, in their 'Sketch of the Natural History of Great Yarmouth,' a much less perfect one being published in 1863, by Dr. B. T. Lowne, under the title of 'A Popular Natural

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* These good old gunning times are now but matters of tradition, the drainage of the marshes, increased traffic, and greater scarcity of wildfowl considerably accounting for the local decrease.

† A variety of *Crossopus fodiens*.

History of Great Yarmouth.' Various records have been made of locally occurring species in the volumes of the 'Transactions' of the Norfolk and Norwich Naturalists' Society. In March, 1896, the Yarmouth Section of that Society published a list of the species compiled by the present writer.

The following abbreviations will indicate the status of the several species and explain the references :—C. common ; F. frequent ; F. C. fairly common ; R. R. rather rare ; R. rare ; A. accidental ; E. extinct ; [ ], doubtful ; Trans. Norf. and Nor. Nat. Soc., 'Transactions' published by the Norfolk and Norwich Naturalists' Society.

Long-eared Bat (*Plecotus auritus*). R. — Have seen and identified examples only on two occasions. One was picked up in the town dead, having in its flight struck the gable of a house and killed itself.

Noctule or Great Bat (*Vesperugo noctula*). F. C.—Several may be seen at one time any summer's evening in the vicinity of water, the Bure being a favourite haunt. Occasionally are very noisy. Will answer to a good mimicry of their shrill notes, and fly close to the performer. Having on one occasion a slightly wounded specimen shrieking in my pocket, its companions came so near that I could feel the "whisk" of their "wings." Its prey is the Cockchafer (*Melolontha vulgaris*), and the Watchman Beetle (*Geotrupes stercorarius*) by preference, whose hard wing-cases it may be heard scrunching.

Pipistrelle (*V. pipistrellus*). C. — Abounds in old houses, outhouses, and churches. I have seen it flitting about in church during evening service. On several occasions have seen examples flying about in the centre of the town at noonday. Discovered two skulls in the "pellet" of an Owl near Yarmouth in August, 1896.

Parti-coloured Bat (*V. discolor*). A.—Reference is made to an example taken from the rigging of a vessel lying in Yarmouth Roads in the year 1834 (*vide* Trans. Norf. and Nor. Nat. Soc. 1873–74, p. 80).

Hedgehog (*Erinaceus europæus*). C — Local prejudice is still strong against this useful vermin destroyer. I have a suspicion it is not so common as formerly. A friend in whose possession a female produced young was gratified in seeing her rear her progeny. I have signally failed in tempting a mother even to notice her offspring.

Mole (*Talpa europæa*). C.—Undoubtedly on the increase on the marsh-lands, and indeed elsewhere, now that Weasels are being so ruthlessly exterminated. On dry uplands have observed it tunnelling near the surface in strawberry-beds, eagerly pursuing the Strawberry Beetle (*Harpalus ruficornis*), which in the daytime remains quiescent about a couple of inches below the surface. I have observed examples swimming in the Bure. Cream-coloured Moles are not rare. "A large rusty-white variety was common at Oby" (*vide* Trans. Norf. and Nor. Nat. Soc. 1870–71, p. 74). Mr. Last Farman records a Mole with two snouts found at Haddiscoe. He has also found maize in Mole-heaps far from habitations; also "pints of worms tied in knots" therein.

Common Shrew (*Sorex vulgaris*). C.—More often found dead than seen alive. In a barrow-load of Owl-pellets I examined at Tunstall, in August, 1896, I found as many skeletons of Shrews as Field Mice (*Mus sylvaticus*). Local, "Ranny"; "Shrew-mouse."

Water Shrew (*Crossopus fodiens*). F. C. — "Marsh ditch-banks; rather rare" (Pagets). More numerous than is generally supposed. Its timidity of disposition and retiring habits make it exceedingly difficult of observation; and even when unaware of one's presence its movements are not easily distinguished, as it worms itself amongst the luxuriant herbage at the ditch-sides. Mostly its tiny bullet-like "plump" into the water is the only indication of its proximity. The variety known as the "Oared Shrew" I have not met with here.

Fox (*Vulpes vulgaris*). A.—"Now (1834) very seldom seen" (Pagets). Undoubtedly the indigenous local race is extinct. Its occurrence as a straggler is of very rare occurrence. One seen at Haddiscoe, about twelve years ago, crossing the river (L. Farman).

Pine Marten (*Mustela martes*). E.—The Pagets, referring to the Marten as *Viverra foina*, speak of it as "formerly at Herringfleet and Toft; now extremely rare." Has probably been extinct in this neighbourhood for half a century.

Weasel (*M. vulgaris*). C.—Notwithstanding incessant persecution is still fairly common. It is no unusual thing to see strings of carcases hanging to warren-fences and gamekeepers' "corners." The Pagets' remark still holds good: "Occasionally seen in the town." On two occasions I have observed it drop from hay-waggons passing along the streets. Have seen it on the marshes assiduously hunting for Field Mice. Local, "Mouse-hunter."

STOAT (*M. erminea*). F.—Still fairly frequent on Rabbit-warrens and in game-preserves. White and blotched examples are occasionally found in winter.

POLECAT (*M. putorius*). R.—"Not uncommon about farm-yards" (Pagets). This remark does not hold good to-day. Rapidly verging on extinction in Norfolk, it is seldom if ever seen now within the ten-mile radius.

OTTER (*Lutra vulgaris*). F. C.—In the Pagets' list this species is referred to as "now seldom seen on any of the Broads where it was once not uncommon." Scarcely a winter passes but one or more are killed; it is astonishing that any remain considering the relentless persecution it is subjected to. Is undoubtedly less rare than is generally supposed; its cautious movements and secretive disposition, combined with the great range of its habitat, enabling the species to defy speedy extirpation. I have kept as pets several from the Broad district; one was a huge savage animal that came to grief through its love for duck-flesh. Another example became so tame as to run loose about the house, and play on the hearthrug with the children. Two, over which I had supervision when in Ireland, were keen on Barcelona nuts thrown to them by the public. The Tench is a favourite prey of the local race.

BADGER (*Meles taxus*). E.—Writing in 1834, the Pagets remark:—"Thirty years ago these were common, especially about Bradwell and Browston, but they are entirely exterminated." Is undoubtedly extinct in East Norfolk. One or two "escapes" have been killed in my recollection. I have kept several in confinement, finding them generally very untractable, differing greatly in this respect from *Vulpes vulgaris* and *Lutra vulgaris*, which in my possession have even exhibited traits of strong affection.

SQUIRREL (*Sciurus vulgaris*). F. C.—In Fritton Woods, and neighbouring woody districts. A few dead specimens brought to market every winter.

DORMOUSE (*Muscardinus avellanarius*). E.—The only evidence

I have of its claim to this list is its presence on Pagets' list: "Occasionally seen in small woods." But I have no knowledge of its occurrence in this part of Norfolk in the present day.

HARVEST MOUSE (*Mus minutus*). F. C.—Though not included in Pagets' list, has an undoubted claim to figure in our own. Nests are occasionally found at Haddiscoe; Mr. L. Farman reports finding them in "quantity in the bottom of barley-stacks." Specimens have been procured alive from that locality.

LONG-TAILED FIELD MOUSE (*M. sylvaticus*). F. C. — Have met with this species occasionally on the North Denes. Have seen a dead one dug out of the "run" of a hunted Stoat, and seen it actually pursued by the Weasel. It appears to be of a very retiring disposition.

COMMON MOUSE (*M. musculus*). C.—Far too common. Whilst a local baker was hunting down a stray Rat, he discovered its lair. He was surprised to find several freshly-killed mice in it. The inference is that the Rat had caught these for food. There is a common local saying that "where you find Mice you are free from Rats."

BLACK RAT (*M. rattus*). C. — "This species still remains here, though its numbers are gradually decreasing; it is now seldom found, except in the ceilings and upper stories of old buildings" (Pagets). "Probably extinct in this county" (Trans. Norf. and Nor. Nat. Soc. 1883–84, p. 674). Than at the present moment the Black Rat was never more numerous at Yarmouth. I have known it from boyhood, and in succeeding years have frequently met with examples, generally dead and mutilated, in the Rows, thrown out from malt- and other warehouses. In 1895 it again forced itself into notice by the apparent increase, although, peculiarly enough, it seemed to flourish in the south-western corner of the town, Regent Street forming a margin to its northward distribution.* Putting a premium on every specimen brought to me, I received over a hundred examples within a few months. Two were examined by Mr. Eagle Clarke, of Edinburgh, who wrote, March 5th, 1896:—"The Rats you send me are most undoubtedly the old English species, *Mus rattus*, and their occurrence in abundance in Yarmouth is an interesting fact. *M. rattus* and *M. alexandrinus* are considered to be *races* of the same species, the black *rattus* being the form found in temperate regions, and the brown *alexandrinus* the tropical one." In summer the Black Rats become troublesome in private houses, warehouses, and stores, and in sail-lofts are keen upon the Russian tallow used there. From one loft I received a whole family of half-grown *rattus* with a white spot in the centre of the chest. As the malting season returns they seem to again concentrate their forces in the maltings. In 1895, having heard of certain smacks being infested with them, I made arrangements with the "watchers," who "smoked" each vessel as it came into port, to secure specimens. After a day and a night's burning of pepper in the vessel, all apertures being closed by boards and mud, the hatches were taken off. I have seen them lying in all conceivable places, the largest generally being near to the stove. From one I had the pick of forty Rats. Amongst them were two or three *M. alexandrinus*. *Vide* Trans. Norf. and Nor. Nat. Soc. vol. vi.

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* I have recently known several killed north of Regent Street.

[Var. *Mus alexandrinus*.—This variety is a duplicate in size and build of the preceding. It is by no means common; I have had less than a dozen examples in all. Most of these came from one large smacks' store-house. The general colour was grey, becoming dirty white below, and inclining to a decided brown upon the backs of some. Gradations from *M. decumanus* to *M. rattus* are not found, nor are any of the physical characteristics of *M. decumanus* observed in this.]

BROWN RAT (*M. decumanus*). C.—"Grey" would be preferable to "Brown." Will undoubtedly increase in proportion to the extirpation of the *Mustelidæ*. It is a pity gamekeepers do not turn their attention to it rather than to its *bonâ fide* enemies, the Stoat, Owl, &c. Abounds on Breydon and the river "walls"; it here assumes a semi-aquatic life.

COMMON FIELD VOLE (*Microtus agrestis*). C.—Unquestionably on the increase. Abundant on some marshes. Is the favourite prey of the Kestrel (*Falco tinnunculus*).

WATER VOLE (*M. amphibius*). C.—Found at almost every ditch-side. "The fact that the Water Vole is somewhat carnivorously inclined, or rather is piscivorous, I am fully satisfied, having observed them on several occasions devouring small fish left on a 'rond' beside my house-boat when moored in Kendall

Dyke. They simply cleared the flesh from the bones. The late Sir E. Newton, in a letter some time previous, suggested the number of broken fresh-water Mussel shells (*Anodonta cygnæa*) as being the work of Voles. On Sept. 12th, 1896, I examined a number at Lound, when I was led to the conclusion that the animals were actually responsible. One valve only was broken, and that always on one particular side, presumably the easier side broken. The excrement of Voles lay against every little batch of broken mollusc."* On one occasion I actually observed a Vole in the daytime endeavouring to drag a Mussel up the bank, and have since received a communication from West Norfolk which clearly pointed out the Vole as partial to Crayfish. Four white examples were killed at Haddiscoe in 1892 (L. Farman).

HARE (*Lepus timidus*). F. C. — Becoming yearly scarcer. I frequently observed this species on the marshes before it was excluded from the game list. Appears, however, to be rather more numerous this year than for some time past. In 1887 Mr. Last Farman shot one at Haddiscoe, almost white in colour, weighing eleven pounds. A mottled Hare caught at Horsey, Nov. 28th, 1896.

RABBIT (*L. cuniculus*). C. — Abundant on the adjacent warrens. Prior to 1880 was frequent on the North Denes, but with the advent of rail and golfers, and the destruction of the furze, it disappeared. Prior to that date, in spring, young bucks not infrequently wandered to within the town boundary; and in the early eighties several made themselves notorious by locating in the cemetery, from which, for the sake of decency, it was found necessary to dislodge them. An earless example was taken in the neighbourhood two years ago, and is now in the Yarmouth Museum.

COMMON SEAL (*Phoca vitulina*). R. R.—Sir Thomas Browne † mentions the killing of a Seal at Surlingham Ferry, "having continued in the river for divers months before." At that time the Salmon was undoubtedly no stranger to the Norfolk rivers. "One [Seal] weighing fourteen stone killed, March, 1822" (Pagets). Of late years Seals appear to have increased in the Wash, where they are comparatively safe from molestation, and even the fishermen look upon them with no unfriendly feelings. Almost yearly during the past decade I have one or more records of occurrences, having drifted hither during heavy tides. In 1896 a coastguardsman killed a specimen sleeping on the beach with his sword-stick. Several have been shot. On Nov. 3rd, 1891, a Seal seized a codling fast to a line against the Yarmouth jetty. Two hooks fastened to it; in endeavouring to land it on the beach the "snoods" broke, and the animal got away.

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* See the writer's note in Trans. Norf. and Nor. Nat. Soc. vol. vi. p. 293.

† Sir Thomas Browne's Works, Wilkins' edit. iii. p. 325.

Grey Seal (*Halichærus gryphus*). R.—Two were killed in the Wash in 1881, where the species undoubtedly occurs occasionally. A young female, drifting into the neighbourhood, came up the river, and was shot on Breydon, Nov. 28th, 1882; it is now in the Norwich Museum. I feel certain another was killed in December, 1897, which I did not see.

[Walrus (*Trichechus rosmarus*). ?.—The claim for this species to be included in the local list is doubtful. "Although now confined to the icy seas of the Arctic Circle, the Walrus was probably not uncommon on our shores in times long past. The skull is said to have been found in the peat near Ely."* On May 1st, 1893, the fore part of a Walrus skull with one tusk in place was dredged up in a shrimper's trawl off Yarmouth. The tusk, 11 in. long, has since been halved lengthwise, and has the appearance of dirty marble. There are a few barnacles still attached to the skull.]

Atlantic Right Whale (*Balæna biscayensis*). A.—Under the name of *B. mysticetus*, the Pagets refer to "a small one taken near Yarmouth, July 8th, 1784." It is highly improbable that this species has ever occurred here, and the Whale referred to was doubtless the Atlantic Right Whale (*B. biscayensis*). Formerly several Yarmouth vessels were engaged in the Whale fishery, and there yet remain several jaw-bones of this animal fixed in various parts of the town, one or two being built in gable walls, and two are to be seen planted as arches in gardens. One standing in the gas-house premises was there when the South Denes were yet unenclosed; it was the custom for those who rambled thither on Sundays to pass through it. Several aged inhabitants still boast of having done so.

Common Rorqual (*Balænoptera musculus*). A.—As *B.*

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* Southwell, 'Seals and Whales of the British Seas,' p. 35.

physalis the Pagets refer to this species as having "several times been taken in the Herring-nets." An example was stranded on Winterton beach, Jan. 12th, 1857, and was killed by the fishermen, who, in conjunction with two or three townspeople, exhibited about twenty tons of the carcase on the Church Plain, Yarmouth. The skull is preserved in the Museum of the College of Surgeons. Another at Happisburgh, March 1st, 1875.

Lesser Rorqual (*B. rostrata*). R.—A full-grown example, thirty feet in length, found its way into Yarmouth harbour on June 8th, 1891. It was attacked by several boats' crews, and, after an exciting hunt, during which the animal received severe wounds, mostly self-inflicted, it succumbed. It was drawn into the lifeboat shed and exhibited, afterwards being preserved and taken on tour to various parts of the country. On Dec. 8th, 1896, an adult dead specimen was stranded on Gorleston beach, where it became very speedily a most unwelcome and unsavoury object, and had to be buried in sections.

Sperm Whale (*Physeter macrocephalus*). A.—The basal portion of the skull of a Sperm Whale stands in the north-west doorway of St. Nicholas Church. It was long known as the "Devil's Seat." "In the churchwardens' accounts for 1606 there is a charge of 8s. for painting this chair, which clearly proves its antiquity."* There remains little doubt, although the date is uncertain, that this example was killed in the latter part of the sixteenth century.

Beaked or Bottle-head Whale (*Hyperoödon rostratum*). R.—As *Delphinus bidens* the Pagets refer to "a large one caught in a Herring-net, November, 1816. A smaller specimen about twenty years before."

Grampus (*Orca gladiator*). R. R.—The Pagets refer to occurrences as follow:—"A specimen weighing 4 cwt. and 11 ft. long found alive on the beach, July 21st, 1823; another, 16 ft. long, caught about 1694,† according to Sir Thomas Browne." Another brought into Yarmouth June 25th, 1867; weight 14 cwt. An example, 7 ft. 6 in. long, taken into Lowestoft harbour on Nov.

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* Southwell, 'Seals and Whales of the British Seas,' p. 87.

† As Sir T. Browne wrote apparently in the year 1662, and says "four years ago," this capture would take place 1658; in Wilkins's edit. iii. pp. 325 and 326, second paragraph.

12th, 1894; seven days after another of exactly the same dimensions brought into Yarmouth by a Herring-boat.

Porpoise (*Phocæna communis*). C.—Frequently seen in the fishery grounds, and not seldom observed when passing through the Roads in summer. Has been seen up-river, and been stranded on Breydon mud-flats. "Two fœtal young ones were taken from a Porpoise at Yarmouth on Dec. 7th, 1881," Southwell (Trans. Norf. and Nor. Nat. Soc. iii. p. 672). A very large shoal passed through the Roads, Jan. 11th, 1890. An example 39 in. long stranded July 18th, 1891; the teeth were barely through the gums.

White-beaked Dolphin (*Delphinus albirostris*). F.— This species, which "was first recorded from Norfolk" (Trans. Norf. and Nor. Nat. Soc. iii. p. 672), has several times been observed, and taken since. Six are recorded prior to 1885. I have met with the following:—Example 7 ft., Gorleston, April 17th, 1890; another, 4 ft. 8 in., on South Beach, April 19th, 1891 (the Gulls had been busy at it); one, 7 ft. 4 in., went through the bridge to Breydon, Aug. 30th, 1891; it had forty-four teeth in the upper jaw, forty-eight below. Several got aground in shallow water at the Caister "patch," Sept. 16th, 1891; they struggled over a considerable area into deeper water. One brought in alive, June 13th, 1894; length, 8 ft. 6 in.; was exhibited alive on the Marine Parade, but ordered off by police. It was killed in a fish-house, and found to be a gravid female; the young contained was 3 ft. 6 in., the short snout was not beyond the arch of the "forehead," which was exceedingly convex. It was apparently within a day or two of birth. Most of the examples examined were females. Local, "Scoulter."

The Common Dolphin (*D. delphis*) has not as yet been detected here.

THE INSECT VISITORS OF FLOWERS IN NEW MEXICO.—II.

By T. D. A. Cockerell,
Entomologist of the New Mexico Agricultural Experiment Station.

The present paper relates mostly to some investigations made in September and October, 1897, during a trip northward up the Rio Grande Valley. The localities visited were Rincon, Albuquerque, Santa Fé, Española, Embudo, and Rinconada.

Rincon, N. M., Sept. 14th.

While the train stopped I was able to do a few moments' collecting, and obtained three species of bees:—

(1). *Nomia foxii*, Dalla Torre. One female at flowers of *Solanum elæagnifolium.*

(2). *Perdita callicerata*, Ckll. At flowers of *Baileya multiradiata.*

(3). *Halictus* sp., apparently new, at flowers of *Gutierrezia sarothræ.*

Albuquerque, N. M., Sept. 15th to 17th.

Altitude 5026 ft. Lat. 35° 05′. Annual precipitation, 7·19 inches. Mean temperature: annual, 55·8°; for September, 68·5°.

The following flowers, which were collected, were not observed to be visited by bees:—*Gaillardia*, prob. *pulchella*, *Aster multiflorus*, *Eriogonum rotundifolium*, *Orcocarya* prob. *suffrutescens*, *Abronia fragrans*, *Astragalus* sp., *Salvia lanceolata*, *Carlowrightia linearifolia*, *Anemiopsis californica*, *Chrysothamnus* (i. e. *Bigelovia*) *bigelovii*, *Flaveria angustifolia* (almost over). The *B. bigeloviii* was common by the roadsides in the part of the town known as the Highlands, and was badly infested by some gall-making dipteron. I am indebted to Prof. E. O. Wooton for the names of these plants.

The following flowers were visited by bees:—

(1). *Cleome serrulata;* visited by *Bombus morrisoni*, Cr., *Podalirius urbanus* var. *alamosanus* (Ckll.), and *Perdita zebrata*, Cr.

(2). *Grindelia* sp.; visited by *Ashmeadiella bucconis* (Say), which is new to the fauna of New Mexico.

(3). *Bigelovia wrightii;* visited by *Prosapis asinina* var. *bigeloviæ*, Ckll. ined., *Nomia nevadensis*, Cr., *Epeolus occidentalis*, Cr., and *Colletes armata*, Patt.

(4). *Helianthus annuus;* visited by *Perdita albipennis* var. *hyalina* (Cr.), *Pseudopanurgus æthiops* (Cr.) *Melissodes agilis*, Cr., *Andrena helianthi*, Rob. (new to N. M.), and *Nomia persimilis*, Ckll. ined., ♀. The females of *Nomia persimilis* mimic *Andrena helianthi* to such a degree that when collecting them I did not distinguish the two species.

(5). *Asper* sp. with purple rays; visited by males of *Nomia persimilis*, Ckll. ined.

There is one thing to be noticed in connection with the above records, namely, that the flowers which attracted the bees are not only of bright colours, but *occur in large masses*, so as to be visible from a distance. The other eleven flowers are either comparatively inconspicuous, or do not occur in large masses, except perhaps the *Anemiopsis*, which seems quite unsuited for bees.

Santa Fé, N. M., Oct. 3rd to 5th.

Alt. 7,026 ft. Lat. 35° 41′. Ann. precip. 14·69 in. Mean temp.: annual, 49·6°; for October, 51·0°.

The end of the bee season was at hand, and few species were on the wing. *Bigelovia* or *Chrysothamnus speciosus* var.? *latisquameus* (det. E. O. Wooton) was still in flower, and attracted *Halictus ligatus*, Say, ♂, *Colletes americana*, Cr., ♀, and females of *Melissodes*, besides some undetermined males of *Halictus*. In a garden, marigolds and marguerites were yet in bloom, and I watched them with interest because, although garden flowers are usually unattractive to wild bees, they are visited when the wild flowers are mostly over, at the end of the summer. The result was as follows:—

(1). Marigolds; visited by males of *Halictus ligatus*, Say, and males and females of some small species of *Halictus* not yet studied.

(2). Marguerite; visited by one ♀ *Perdita snowii*, Ckll. This was a most interesting capture, as the species was hitherto known only by a unique specimen taken in Colorado. On Oct. 2nd I took at the marguerite a ♀ *Perdita zebrata*, Cr. (which normally visits *Cleome*), and a ♀ *Halictus*.

A single patch of the wild golden-rod (*Solidago canadensis*), almost over, was visited by a ♀ *Halictus* on Sept. 20th.

Española, N. M., Sept. 25th.

Two males of *Halictus* were taken while the train stopped. There were found here, close to the station, not only the common *Xanthium canadense*, but a quite different species of *Xanthium*, which to my surprise is reported by Prof. Wooton as differing from anything in the herbarium of Columbia University.

Embudo, N. M., Sept. 25th to 27th.

Alt. 5800 ft. Lat. 36° 10′. Ann. precip. 9·74 inches.

This locality was entirely new ground, entomologically speaking.

The following flowers were collected, but were not observed to be visited by bees: — *Nasturtium sinuatum*, *Campanula parryi*, *Melilotus indica*, *M. alba*, *Fallugia paradoxa*, *Amarantus palmeri*, *A. græcizans*, *Bahia absinthifolia*, *Aphyllon multiflorum*, *Euphorbia serpyllifolia*, *Polygonum* (perhaps *pringlei*). These were all determined by Prof. E. O. Wooton. In the Mesilla Valley *Melilotus indica*, when massed in quantity, as was not the case at Embudo, is attractive to small bees (*Halictus*, *Sphecodes*, *Calliopsis*, *Prosapis*) at the beginning of May. I have taken *Nomia nevadensis* at *Fallugia paradoxa* at Albuquerque at the end of June; it is fairly attractive to hymenoptera when occurring in quantity; when collected at Embudo it was nearly over, only an occasional flower being seen. On Aug. 13th, at Mesilla, I saw *Aphyllon multiflorum*, Gray, persistently visited by a *Ceratina;* a single honey-bee also visited the flowers. The flowers turn indigo blue when subjected to cyanide fumes.

The following flowers at Embudo were visited by bees:—

(1). *Cleome serrulata.* Almost over; visited by *Prosapis* n. sp., ♀.

(2). *Bigelovia* (or *Chrysothamnus*) *viscidiflora* (det. E. O. Wooton).

(3). *Bigelovia* sp.

There were two species of *Bigelovia*, but unfortunately when collecting I did not at first appreciate this fact, and the collections were not separated. From the lower-growing form I took *Perdita rhodura*, Ckll. ined. (abundant), *Andrena vulpicolor*, Ckll. ined. (several), *Podalirius maculifrons* (Cr.), *Agapostemon*. sp. ♂, and a ♂ *Colletes* new to me. On the taller species *Perdita affinis*, Cr. (new to N. M.) was common. The other *Bigelovia* bees at Embudo were *Colletes americana*, Cr., ♀, *C. simulans*, Cr., ♀ (new to N. M.), *Perdita subfasciata*, Ckll. ined. (one), *P. townsendi*, Ckll. (hitherto supposed peculiar to the White Sands), *Calliopsis coloradensis*, Cr. (one), and sundry females of *Melissodes*. The new *Andrena vulpicolor* is a particularly fine species, with the thoracic pubescence of a foxy-red colour.

To complete the list of Embudo bees, it may be mentioned that a female *Agapostemon texanus*, Cr., was taken from a hole in the ground.

Rinconada, N. M., Sept. 26th.

This is only a few miles above Embudo. Two species of flowers were visited by bees:—

(1). *Verbesina encelioides;* visited by *Halictoides marginatus* (Cr.), *Heriades variolosa* (Cr.), which is new to N. M., *Megachile* sp. ♂, *Megachile* sp. ♀, and *Megachile* sp. ♀.

(2). *Bigelovia*, a tall species; visited by *Melissodes menuacha*, Cr., *Colletes americana*, Cr., *Colletes* sp. ♂ (new to me), *Agapostemon* sp., ♂, and *Calliopsis* n. sp. near *coloradensis*. Also by the butterfly *Pyrameis cardui* and the syrphid fly *Chrysogaster bellula*, Williston.

It is thus seen that the visitors observed at these two Compositæ were entirely different.

Las Cruces, N. M., Sept., Oct., 1895.

The following collections of autumnal bees have not heretofore been reported:—

(1). *Verbesina encelioides;* Oct. 9th, visited by a ♀ *Pseudopanurgus æthiops* (Cr.).

(2). *Aster hesperius*, Gray; Oct. 4th, seemed little attractive to bees: visited only by *Agepostemon melliventris* (Cr.), ♂, and a ♂ *Halictus*.

(3). *Baileya multiradiata;* Oct. 23rd, visited by *Parandrena rhodocerata* (Ckll.).

(4). *Helianthus annuus;* Sept. 21st, visited by *Panurginus perlævis* (Ckll.), *Halictoides marginatus* (Cr.), in great numbers, *Andrena pulchella*, Rob., *Melissodes agilis*, Cr., and *Podalirius maculifrons* (Cr.).

It is curious that the sunflower *Andrena* at Las Cruces should be *A. pulchella*, while that at Albuqerque is *A. helianthi*.

Las Cruces, N. M., Aug. 23rd, 1897.

In the *Larrea* zone close to Las Cruces the following were collected by Prof. C. H. T. Townsend and the writer from flowers of *Cevallia sinuata*, Lag. (Loasaceæ):—

Melissodes luteicornis, Ckll., ♂, *Centris cæsalpiniæ*, Ckll., ♂, *Podalirius californicus*, Cr., ♂, *Anthidium maculifrons*, Sm., ♂, *Bombus* near *fervidus*, prob. n. sp.

Mesilla, N. M., Aug. 21st, 1897.

The flowers of *Martynia* sp. were observed to be visited by *Podalirius vallorum*, Ckll., ♀. On Aug. 19th, at Mesilla Park, *P. vallorum* ♂ was visiting a cultivated *Chilopsis*. The two species of flowers mentioned, though of quite different affinities, are not dissimilar in colour and form.

Mesilla, N. M.

OBITUARY.

Osbert Salvin.

The death of this well-known and highly-respected ornithologist and entomologist took place suddenly, though not altogether unexpectedly, at Hawksfold, near Haslemere, on June 1st, from an old-established heart disease, which had been borne stoically and contemplated cheerfully. He was born at Finchley in 1835, and was the only surviving son of Mr. Anthony Salvin, a well-known architect. Shortly after graduating at Cambridge as Senior Optime in the Mathematical Tripos of 1857, he made a Natural History Expedition to Tunis and Algeria, in the company of Mr. W. H. Hudleston and Mr. (now Canon) Tristram, both of whom survive. In the autumn of the same year he made the first expedition to a country with which his life's work was to be largely associated; this was his visit to Guatemala, where he stayed chiefly in company with the late Mr. G. U. Skinner, the well-known collector of orchids, till the middle of 1858, revisiting the same region in about a year, and for a third time in 1861, in company with his friend and future coadjutor, Mr. F. D. Godman. After his marriage, in 1865, he with his wife made a fourth journey to Central America. There can be no doubt that these expeditions incited the project and prepared the way for the publication of 'Biologia Centrali-Americana,' of which 142 parts have already appeared, and which is still unfinished.

From the foundation of the Strickland Curatorship in the University of Cambridge, in 1874, Mr. Salvin accepted and held that office until 1883, when he succeeded to the family estate. As an ornithologist, he edited the third series of the 'Ibis,' of which he was one of the founders; was author of a 'Catalogue of the Strickland Collection' in the Cambridge Museum; to the British Museum Catalogue of Birds he contributed the enumeration of the *Trochilidæ* and *Procellaridæ;* completed and arranged the late Lord Lilford's 'Coloured Figures of British Birds,' and was the author of many ornithological papers, some published by himself alone, and others conjointly with Dr. Sclater and Mr. Godman. With the last named he contributed the ornithology to the 'Biologia Centrali-Americana,' still uncompleted. As an entomologist he was a lepidopterist, and confined himself to the Rhopalocera. His great work is of course in the 'Biologia,' written in conjunction with Mr. Godman, and nearing completion with the *Hesperiidæ*. In this last family we see a matured view of treatment, where the structural characters of anal appendages are largely used in specific differentiation, a principle not insisted on in the earlier parts of the work.

But a bare recital of published work scarcely fulfils the compass of this obituary notice. In association with his life-long friend Mr. Godman we see a capacity and love for scientific zoology combined with the accident of wealth which are phenomenal. The publication of the 'Biologia Centrali-Americana' is an unique event both in project and realization. Its conception not only proclaimed a devotion to zoological labour on the part of its editors, but declared an optimism in the expected assistance of other workers, which was generally seen to be amply justified. The expense of production would have strained the available finances of a small state, and would have required a financial vote—not likely to have been granted—of an enlightened empire. Such amounts are privately wasted every year, but seldom contributed to science, especially to such a sober and non-advertising science as zoology.

Nor must we overlook the fact that, though of a modest and retiring nature, Mr. Salvin still exercised a great personal influence in official biology. He not only was a member of, but also a frequent office-holder in, our Natural History Societies, to which he was a regular visitor and active councilor, while his friend and coadjutor is a Trustee of the British Museum. It is probable that it will be long before such an union occurs again as produced the 'Biologia,' and made the rooms in Chandos Street such a zoological rendezvous.

NOTES AND QUERIES.

MAMMALIA.

CHIROPTERA.

Daubenton's Bat in the Conway Valley.—When staying at Bettws-y-Coed last May, I used to see this Bat (*Myotis daubentoni*) every evening, skimming in its characteristic and unmistakable fashion over a quiet reach of the Llugwy. I also saw it at Llyn-yr-Afange, a beautiful pool on the Conway, whose name is said to recall the fact that the Beaver once inhabited the stream.—CHAS. OLDHAM (Alderley Edge).

AVES.

Nightingale Nesting at Wells, Somerset.—I am pleased to report that a pair of these beautiful songsters (*Daulias luscinia*) have again nested in a wood just outside the town known as Park Wood. The nest, composed of dried grasses and last year's oak leaves for the exterior, with finer grasses and the skeletons of old oak leaves for the interior, is placed in the centre of a tall grass-stalk, supported on one side by the low hanging branch of the wild sloe, and contains five eggs, all of a uniform olive-brown colour; the nest is uncommonly deep and cup-shaped. On leaving the nest the female flew a few yards through the undergrowth, keeping close to the ground, the reddish tint of the tail-feathers being very noticeable. It is worthy of note that five young ones were hatched here in safety last year.—STANLEY LEWIS (39, High Street, Wells, Somerset).

When does the House Martin arrive?—Having noted the arrival of spring visitants for thirty-nine years, I should say that Messrs. Fowler and Aplin's records show very well the average time of arrival of this species (*Chelidon urbica*). In the following thirty-seven records (those for years 1863 and 1864 unfortunately lost) by my brothers and myself, there is a considerable gap between the earliest and latest notes, *viz.* April 13th and May 12th; but we early became accustomed to expect the bird considerably later than the Swallow, and not so very much before the Swift. It will be noted that this year (1898) gives the only record of arrival so early as second week in April.

1860, May 12th (two)	Ealing.
1861, April 25th (several)	Ealing.
1862, April 28th (one)	Rainham, Kent.
1865, April 28th (one)	Rainham, Kent (visiting old nest).
1866, April 16th (two)	Rainham, Kent (visiting old nest).
1867, May 4th (five)	West Drayton.
1868, April 23rd (one)	Sandhurst.
1869, April 28th (one)	Belvedere.
1870, April 25th (one)	Wells, Somerset.
1871, May 4th (several)	Wells, Somerset.
1872, May 3rd (one)	Lewisham.
1873, May 5th (one)	Lewisham.
1874, April 24th (several)	Windermere.
1875, April 19th (one)	Nottingham.
1876, April 23rd (two)	Southend, S.E.
1877, May 12th (one)	Lewisham.
1878, April 27th (one)	Gloucester.
1879, April 23rd (four)	Southend, S.E.
1880, April 19th (one)	Nottingham.
1881, April 19th (one)	Walton-on-Thames.
1882, April 25th (one)	Nottingham.
1883, May 4th (one)	Nottingham.
1884, April 30th (one)	Nottingham.
1885, April 20th (two)	Nottingham.
1886, April 24th (one)	Nottingham.
1887, May 3rd (one)	Brixton.
1888, April 30th (one)	Nottingham.
1889, May 5th (two)	Brixton.
1890, May 7th (five)	Northfleet, Kent.
1891, April 25th (one)	Nottingham.
1892, May 8th (three)	Greenhithe.
1893, May 1st (one)	Nottingham.
1894, May 2nd (two)	Brixton.
1895, April 25th (one)	Brixton.
1896, May 5th (one)	Nottingham.
1897, May 4th (three)	Tooting.
1898, April 13th (one)	Dulwich.

The above dates worked out show that the bird was first seen once in the second week of April, five times in the third week of April, fourteen times in the fourth week of April, thirteen times between April 29th and May 6th, four times between May 7th and 12th; and therefore twenty-seven out of thirty-seven records give the arrival between April 22nd and May 6th. Mr. Fowler's records come out rather stronger than my own in averaging the arrival of the bird between these dates, *viz.* thirteen out of sixteen. — F. D. Power (299, Cold Harbour Lane, Brixton).

Nesting of the Greater Spotted Woodpecker near Bath. — Quite recently (June 19th) I discovered a nest of the Greater Spotted Woodpecker (*Dendrocopus major*) near this town, which contained young ones. The hole was in an ash tree, and, judging from its worn appearance and scarcity of wood-chips, had evidently been used more than one season. The incessant noise of the young birds first attracted my attention to the spot, and I am certain they must have betrayed their whereabouts to several people besides myself, as the noise they make can be heard a considerable distance. I visited the nest on two consecutive days, and by keeping quiet obtained each time a close view of one of the parent birds, probably the hen. I also photographed the nesting site. I am sorry to say that the tree has been "blazed," and a number painted on it, which evidently means that it is to be cut down, though when I cannot tell. I shall be very sorry when the tree falls, as the Greater Spotted Woodpecker is a great rarity around Bath, and this is the first instance of its nesting here which I have personally come across. It is far rarer than its congener, the Lesser Spotted Woodpecker, and I have not seen a living specimen for a number of years. The bird was very uneasy at my presence so near the nest, and made a great noise; its note was a sharp "chick." I will not mention the exact locality of this nest, for reasons which all will understand.—C. B. Horsbrugh (4, Richmond Hill, Bath).

Nesting of the Greater Spotted Woodpecker at Wells, Somerset.—On May 14th of this year I was fortunate enough to find the nesting place of a pair of Greater Spotted Woodpeckers (*Dendrocopus major*). On my approaching to within a few yards of the tree one of the parent birds flew out of the hole. On again visiting the nest (May 28th) I found it contained young ones; the parent birds came and went several times whilst I remained unseen, and the cries of the young ones I could distinctly hear. The entrance hole, hewn out by the birds themselves, is situated six feet from the ground in the trunk of a small and somewhat decayed apple tree; the diameter of the hole is exactly two inches in the clear. On bringing the young ones food, I noticed that the old birds always alighted on the trunk close to the ground, and climbed upwards to the hole. These lovely birds are very uncommon in this district, and are entitled to every protection.—Stanley Lewis (39, High Street, Wells, Somerset).

Breeding of the Gannet.—When off Berry Head in my yacht, I saw, on May 28th last, about ten or twelve Gannets (*Sula bassana*) fishing. I cannot call to mind that I ever saw these birds so far south at this time of year. Can any of your readers inform me whether they breed anywhere in that neighbourhood?—R. J. Balston (Springfield, Maidstone).

Scaup in Bedfordshire.—On the 22nd May last I saw a bird of this species (*Fuligula marila*) on the sewage farm at Bedford, which from its plumage was apparently a female. It had dusky plumage and a white face. This bird remained in the neighbourhood for some days. It is possible, having regard to the date, that this bird had escaped from some ornamental water, but of course it may have been blown inshore by a gale. Perhaps some of the readers of 'The Zoologist' may have heard of the escape of one of these birds, in which case all doubt as to the genuineness of the occurrence would be satisfied.—ALAN FAIRFAX CROSSMAN.

Alleged Kentish Plover in Bedfordshire.—On the 26th May last I was watching a small party of Ringed Plover and Dunlin at the Bedford Sewage Farm. On observing the former closely through my field glasses, I noticed that one of them differed considerably from the rest, more especially in not having the complete black gorget, but only black patches on the shoulders, and also in having dark legs instead of yellow ones as the rest had. It was also a lighter colour on the back. I made a note of these points, and found, on reference to Mr. Howard Saunders's 'Manual,' that I was correct in identifying this bird as the Kentish Plover (*Ægialitis antiana*). I am not aware of the occurrence of this bird in Bedfordshire on any previous occasion.—ALAN FAIRFAX CROSSMAN.

Iceland Gull in Co. Sligo in Summer.—On June 18th, when driving from Enniscrone to Oghill, about two miles from the sea, I passed a field that was being prepared for turnip-sowing, and to my great surprise, amongst a flock of about twenty immature Herring Gulls, I perceived an Iceland Gull (*Larus leucopterus*). The bird, as usual, was very tame, feeding within three or four yards of the man and horses, and, as it fed within ten or twelve yards of the public road where I was standing, I had an excellent opportunity for observing it with my glass. It appeared to be a bird of last year, for, although the head and neck were very light coloured, the shoulders and back were rather dark; but the long white primaries were very conspicuous. Probably the bird would not exhibit the creamy coloured stage of plumage until after this autumn's moult. The occurrence of the Iceland Gull in summer is very unusual, and the only other occasion on which it has been observed at this time of year in this county was on June 5th, 1896, when an adult specimen was found dead on the sands of Mullaghmore by Mr. C. Lanham, of Tempo Manor, Co. Fermanagh.—ROBERT WARREN (Moyview, Ballina).

Note on the Petrel, Oceanodroma castro (Harcourt).—In recently looking over the Fourteenth Report on Danish Birds,* compiled by Herr Herluf Winge, and published in the Danish journal 'Videnskab. Meddel. fra den naturh. Foren. i Kjöben.' for 1897, pp. 237–310, I was surprised to learn that two examples of this species (better known as *O. cryptoleucura* (Ridg.), but see the 'Ibis,' 1898, pp. 313, 314) were killed at lightships in September and October, 1896. Herr Winge has access to specimens in the University Museum at Copenhagen, and, after comparison of the two specimens in question with skins of *O. leucorrhoa*, he is evidently of opinion that

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* Fuglene ved de danske Fyr i 1896. | 14 de Aarsberetning om danske Fugle. | Ved | Herluf Winge. | Med et Kort.

O. castro cannot with justice be considered as specifically distinct from the last-mentioned species. In support of this view Herr Winge gives a table of measurements (*ut supra*, p. 247), intending to show that the two examples of *O. castro* differ from each other as much as from a typical example of *O. leucorrhoa*.—W. Ruskin Butterfield (St. Leonards-on-Sea).

Notes from the Isle of Man, 1897.—The bay of Castletown, the shore of which at low water shows a considerable extent of low weedy rock, interspersed with tide-pools and rough gravelly patches, is perhaps the most suitable resort in the island for shore birds, to which the general character of the Manx coast is not attractive. During May, 1897, small parties of Whimbrel (*Numenius phæopus*) frequented the shores; they left about the commencement of June. A party of eight or ten Turnstone (*Strepsilas interpres*) was also on the rocks, and some dozen of Sheldrakes (*Tadorna cornuta*), of which at least one pair probably stayed to breed somewhere in the neighbourhood. On the little greensward and sandy links bordering the shore, Wheatears (*Saxicola œnanthe*) appeared in numbers in May, but all seemed to pass on as the season advanced. Late in May considerable numbers of Dunlin (*Tringa alpina*), mixed with Ringed Plover, arrived on the sands. Parties continued to be seen in June, and again in July and August; they were abundant, many in breeding plumage. Their tameness contrasted with the shyness of the usual winter residents of the same species. The Redshanks (*Totanus calidris*), which for the greater part of the year enliven the tide-pool, almost disappeared during the early summer; by the beginning of July they were returning; also many "Black-headed" Gulls (*Larus ridibundus*), often still bearing the dark hood, and Common Sandpiper (*Totanus hypoleucus*) made their appearance here and there on the coast; one of these, roused from a stagnant pool, settled on a garden wall close by. On July 22nd I rowed from Port Erin round the Calf of Man. Sea-birds were there in very large numbers, especially Puffins (*Fratercula arctica*). As they are strictly protected by the proprietor, it is to be hoped that this interesting islet, now quite unassailable, at least from the land side, may long continue to be a refuge. On Nov. 28th, a cold and stormy day, a Swallow (*Hirundo rustica*) and Martin (*Chelidon urbica*), the former certainly and the latter probably a young bird, were flying together around the walls of Castle Rushen. They had been in the neighbourhood for about a fortnight previously, but after this day were not seen. On Dec. 23rd I found the remains of a Chough (*Fregilus graculus*) on the edge of a mountain summit 1400 ft. above sea-level, in the district which is the headquarters of the bird in the Isle of Man. On Dec. 26th there was in the bay a "Black-headed" Gull with the dark hood complete. The early assumption of this character seems not uncommon in our mild winter climate.—P. Ralfe (Castletown, Isle of Man).

Birds singing during Thunderstorm. — It was curious to notice, during a heavy thunderstorm on May 23rd, many Thrushes singing most lustily, and also a few Chaffinches. The terrible peals of thunder, flashes of lightning, and the deluge of rain did not disturb them in the least. Are there many species of birds which sing under such conditions? — C. B. HORSBRUGH (4, Richmond Hill, Bath).

The Protection of Wild Birds and their Eggs.—I have long had it on my mind to address a few words on this subject to 'The Zoologist,' and my pen has been quickened by the receipt during the last few days of letters and circulars from sundry sources inviting an exchange of eggs. My egg-collecting days have long since gone over, and though, admittedly, I once on a time derived an immense amount of pleasure from the hobby, it was never associated with such wanton and wholesale spoliation as obtains in certain districts nowadays—in flagrant and contemptuous defiance of the law. I write in no narrow-minded spirit, for I am very tolerant of egg-collecting in a humane fashion by boys who have a *penchant* for natural history, and of egg-collecting in reason by scientific ornithologists; but my hobby just now, and for the future, is the devotion of my energies to the preservation of birds, and the protection, within certain limits, of their eggs. Since the middle of April I have been wandering about the country, studying birds in their breeding haunts; I wound up my tour by staying for a week at a very pretty spot in one of the western counties, which boasts a stringent and not altogether ill-conceived "order" for the protection of sundry wild birds and their eggs during the summer months. I say "not ill-conceived" advisedly, for some of the "orders" of a kindred nature issued by County Councils elsewhere can only be regarded as legislative absurdities. However, this by the way. As for any heed or respect being paid to these "orders" in the majority of cases, it is out of the question to expect such a thing; while the following will illustrate the lengths to which contempt for the same can go. Before the end of my sojourn in the county to which I have particularly referred, I found that many of the boys for miles round were in the habit of collecting eggs for a certain individual in the neighbourhood, and of course were paid for them. This I heard incidentally had been going on for years. If ever I met a boy on the road, and enquired if he had any eggs, the answer was sure to be, "Yes; but I'm going to take them to ——." I went to one boy's home, and glanced over the result of his depredations; scores and scores of eggs, most of them belonging to our commoner summer migrants, in all stages of incubation, and many of them of no value whatsoever, met my eye. Nests were taken wholesale as well as eggs, and in the nests were placed slips of paper purporting to bear the dates on which the various clutches were taken. Such dates were mostly imaginary, as I had ocular proof; but this is a detail.

Now it is quite conceivable that complete clutches, with alleged full *data*, of eggs of the Redstart, Blackcap, Garden Warbler, Golden-crested Wren, Dipper, Kingfisher, Redbreast, Common Sandpiper, Goldfinch, Turtle Dove, Tree Pipit, Chiffchaff, Nuthatch, Green Woodpecker, and Long-tailed Tit, &c., despatched here and there to collectors at a distance, may bring in exchange some rarity not procurable at home. But, to my thinking, a collection of eggs so vicariously amassed, and by means of pillage so eminently unscrupulous, is shorn of attractiveness and merit in no inconsiderable degree; while for a scattered army of boys, naturally reluctant from the very nature of their bargain to exercise the slightest discrimination, to be notoriously holding what may be appositely defined as oological briefs for an individual whose daily avocation is of a strictly professional nature, surely constitutes—in face of modern, and, at all events, well-meant legislation for wild birds and their eggs, and the fact that private enterprise is now doing excellent work in the same interests throughout the length and breadth of the country—a reflection on the neighbourhood. There can be few—very few—who have sympathy with the greed that prompts an organized spoliation of the nests and eggs of our wayside and woodland minstrels.—H. S. DAVENPORT (Melton Mowbray).

AMPHIBIA.

Toad attacked by a Frog.—A number of notes have recently been published in the 'Field' describing "cannibalism" among Snakes; it may be useful to state that the practice is not unknown among Batrachians. When in the Transvaal I found that the electric lights of Pretoria not only attracted insects, but were regularly visited by Batrachians, who enjoyed the banquet of falling insects after impact with the light above. On one occasion my son, at one of these zoological rendezvous—and we must not forget the Bats that constantly hunt above—found a Toad (*Bufo regularis*) half-swallowed, head first, by a large Frog (*Rana adspersa*). He brought me the two specimens still in that condition, and they are now in my collection, though the Frog naturally disgorged the Toad on immersion in spirit.

The subject of "Enemies of the Toad" received some attention in the pages of 'The Zoologist' for 1897 (pp. 339, 369, and 432). We have now added the Frog as above, and fish also must be enumerated among the numerous animals that attack this unsavoury creature. Live Toads are stated to be the best bait for Cat-fish ('Audubon and his Journals,' vol. ii. p. 210); whilst Mr. Hudson once examined a good-sized fish (*bagras*) which had evidently died shortly after swallowing a large Toad ('The Naturalist in La Plata,' p. 78).—ED.

NOTICES OF NEW BOOKS.

The Angora Goat, and a Paper on the Ostrich. By S. C. Cronwright Schreiner. Longmans, Green & Co.

Now that so much attention is focussed on Southern Africa, it is quite refreshing to find that the *Hominidæ* are not the only mammals studied in the area, and that, besides the introduced Boer farmer, there is also the Angora Goat. We are absolutely dead weary of the political questions connected with the Boer, and rejoice to study the less exciting but more scientific problem of his Goat. And here let us at once clear the ground by a definition; by Boer we do not necessarily mean an inhabitant of the Transvaal, but the farmers who trace their descent back to the early settlers, are of principally Dutch and French origin, who use the "Taal" dialect, so largely Dutch in its construction, and are found all over South Africa, under the British flag as well as beneath those of the two Republics.

The first part of the volume is devoted to the history and derivation of the various breeds of domestic Goats, and our author agrees with the now generally accepted opinion that they are all principally derived from the Persian Wild Goat (*Capra ægagrus*), and that the blood element of the Wild Goat of Thibet (*Capra falconeri*) in the Angora breed must be small indeed, as "the outward twist of the horns, so pronounced in *Capri falconeri*, is unknown in the Angora (whose horns have the twist inwards) or any other domestic variety."

One reason for the great success with which the Angora breed flourishes in South Africa is pointed out by Mr. Schreiner in the fact that "our veld and climate are almost identical with those of the province of Angora." And this remark is true for the Colony, for practically "the Transvaal has no Goats and the Free State not a very large number." In 1893, the Cape had 2,811,206 Angora Goats, and 2,819,749 Common Goats. The effects of crossing is favourable to the fecundity of the Angora, the modern breed having often two kids at a birth, the Kurd Goat having seldom less than two; while at the Cape, Angoras descended from a cross with the Boer Goat, generally have twins, often triplets, and sometimes four young at a birth. But as Angoras in the Colony "are becoming purer and more what they should be, the tendency of ewes to have more than one (even now not common in the best stud flocks) becomes less and less."

The first importation of Angoras into the Cape Colony (or South Africa) was made in 1838 by Colonel Henderson, formerly of Bombay); and of the fourteen Goats that landed, only two, a ewe and her ram kid, may be noticed, for the other twelve rams had been rendered impotent before leaving Turkey. As remarked by our author:—"The day on which the little fellow leapt ashore, beside his dam, fifty-nine years ago, at Table Bay, is a memorable date in the history of South African pastoral products." It is indeed! for South Africa is economically a "poor man's country"—"black man's country"—the usual appellation; take away its mining capacity and it is again within measurable distance of a pastoral condition. The introduction of the Angora Goat is therefore an event of more real significance to many in S. Africa than an elargement of boundaries or a diplomatic triumph. The natives from the time they were first met possessed a practically indigenous Goat, and the "Boer Goat of to-day strikes one as an animal peculiarly South African, as it browses on the arid kopjes of the Great Karoo." This hardy animal, with its coat "short, smooth, and coarse, of almost any colour or combination of colours, frequently being dappled," which can live and thrive where other stock would die, with its pungent and strong flesh naturally survives, and according to the 1891 census numbered then no fewer than 3,444,019, or about 250,000 in excess of the number of Angoras. They can be trained—the Kapaters—as "voerbokken," leaders to flocks of sheep and understanding certain words of command. "It is an odd spectacle to see a couple of immense gaily-coloured Kapaters marching as directed to the front of a flock, and sedately—one almost imagines proudly—leading the way into a kraal or through a gate with the sheep trooping closely after them." These Boer Goats have supplied the mothers of nearly all the Cape Angoras.

The volume is well illustrated, and is full of statistics as to a very staple industry of South Africa, and is of interest alike to the zoologist, farmer, and political economist. The paper on the Ostrich appeared in these pages last year.

Elementary Practical Zoology. By FRANK E. BEDDARD, M.A. (Oxon.), F.R.S. Longmans, Green & Co.

THIS small volume forms one of "Longmans' Practical Elementary Science Series," and is intended as a guide to the elementary zoology required by the Science and Art Department. It might with advantage be used as a school course of zoological teaching, for its small compass would not make it too great a competitor with other studies, and its contents could be mastered by the teacher, which is after all the desideratum of an elementary book of science, if it is eventually to reach the pupil.

Mr. Beddard commences with the *Amœba*, follows on with the *Hydra*, and then discusses the Earthworm, on which he is so well known as an authority; to which succeeds the Crayfish, ever memorable from the classic of Huxley; the Cockroach, another type recently investigated by Miall and Denny; and successively treats of Insects and their metamorphoses, the Pond Mussel (*Anodonta cygnæa*), the Snail, the Frog, and thence to Vertebrates. We are not surprised to read that "the classification of the animal world adopted in this book will be found to differ from many schemes of classification in vogue," and most students will agree with the author that this may be "because of the uncertainty of our knowledge, and the consequent variability of opinions."

An elementary biological fact, not too often emphasised in elementary works, is clearly and tersely stated by Mr. Beddard with reference to the reputed distinction between animals and plants. "It is not possible to draw a clear line between plants and animals." How fundamental this appreciation is to any intelligent conception of organic evolution it is unnecessary to remark; to have it clearly stated in a primer is no small service. There are some apparent phenomena which, even now, ordinarily educated people only disbelieve because they are told to do so, such as the seeming movement of the sun; and such observers will feel little doubt of the essential life differences between an Ox and an Oak; but when we approach what may be called the introduction to organic life, we may well hold with the author, "that there is no absolute criterion for determining whether a given unicellular or few-celled organism is a plant or an animal." Such axioms really lie at the base of all biological philosophy, and to have them taught early is to have them taught well.

Ackworth Birds: being a List of Birds of the District of Ackworth, Yorkshire. By Major WALTER B. ARUNDEL. Gurney & Jackson.

THIS is the latest addition to our local lists of British birds; it is confined to "Ackworth and the neighbourhood around for a distance of from three to four miles"; the soil is for the most part loam or clay, and in some places is marl; it is about fifty miles from the sea-coast at its nearest point; the river Went—a small stream tributary to the river Don—runs through the centre of the district, which also includes the lake at Nostell and Hemsworth Dam; while against these natural beauties we read that "half-a-dozen collieries are worked within, or close to, the district, towards its northerly and westerly confines."

The total number of species enumerated is 149, of which 54 are permanent residents, 26 regular summer residents, 9 regular winter residents, and 60 visitors. We are glad to find "that, in spite of the arts and designs of the gamekeeper, the Magpie is common in all wooded parts." In connection with this bird an observation by a local farmer is recorded, of five Magpies surrounding a Fox who was devouring a Rabbit, and on his being disturbed picked up the remainders. A "Rooks' parliament," as witnessed by Dr. George Wood and the first Lord St. Oswald, is an example of what has been loosely called the romance of natural history. "A multitude of Rooks were formed up in a large ring, in a field, round a solitary, dejected-looking member of their species, and were making a great noise and flapping of wings, the only silent and quiet bird being the miserable individual in the centre of the ring. All at once there was perfect quietude and stillness, which lasted a minute or two, when suddenly the noise was resumed with unabated vigour, and the birds forming the ring closed in upon the unhappy one and instantly despatched it, literally pulling it to pieces, amidst a general tumult. Dr. Wood was unable to say whether the victim, upon which judgment was summarily dealt, had been previously injured, or was otherwise imperfect." With a diseased pity for evil-doers who incur severe penalties, our soul goes out to that Rook.

There are many other interesting observations and facts in avian life to be found in this small volume. A Cuckoo was found a prisoner in a Redbreast's nest at Ackworth Court, the nest being so encompassed by ivy-growth as to make it necessary to cut away the stems in order to liberate the mighty fledgling. The importance of a Heron to a Trout-stream is amply verified by the statement that "out of the gullet of a Heron, shot at Ackworth in 1890, fell three Trout, each of about half a pound in weight." This list appears to have been made with care, and is much more than a mere inventory.

A Pictorial and Descriptive Guide to the Lake District.

Ward, Lock & Co. Limited.

ALTHOUGH not announced on the title-page, this 'Guide' has been edited and largely written by Mr. G. W. Murdoch, who conducts the natural history columns of the 'Yorkshire Weekly Post.' Besides its natural beauty, Lakeland will ever remain classic with the name of Wordsworth, while De Quincey first drew attention to the evidences of a prolonged Norse or, as he expressed it, Danish occupation of the district. The poet Gray is generally credited with having "discovered" the Lake District, which he visited in 1769, and described in his 'Tour in the Lakes;' but, as Mr. Murdoch observes in his introduction, "it was neither industrial progress nor Gray the poet that 'opened up' the Lake District, but Wordsworth, Southey, the Coleridges (father and son), Wilson ('Christopher North'), De Quincey, and afterwards Mrs. Hemans, Harriet Martineau, Dr. Arnold (of Rugby), James Spedding, and (in many ways one of the most charming of all that brilliant intellectual galaxy) the gifted Dorothy Wordsworth."

We are not, however, principally concerned with literature—in its restricted meaning—in these pages, nor with Border raids and plunderings, but rather with the "natural history of the Lake District" which forms a new feature of this 'Guide.' This contains a reference to most publications on the subject, and it is notworthy to read of John Gough, the blind naturalist of Kendal, born in 1757, who "was the first (blind though he was) to throw much true light on the bird-life of his native county." The Mammals, Birds, Reptilia, Amphibia, and Freshwater Fishes (under Angling), are briefly alluded to, and we can recommend this inexpensive 'Guide' to all lovers of nature who contemplate visiting this beautiful region.

EDITORIAL GLEANINGS.

In the last 'Annual Report of the Board of Regents of the Smithsonian Institution' for the year ending 1895—date of publication 1897—Dr. R. W. Shufeldt, author of 'Scientific Taxidermy for Museums,' draws attention to the "Taxidermical Methods in the Leyden Museum, Holland." This contribution has been induced by the receipt of "a MS., illustrated by a large series of photographs, received from Mr. H. H. ter Meer, jun., on the staff of, and præparator to, the Museum of Natural History of Leyden." The author explains that in Holland taxidermy is discouraged by the fact "that the Dutch biologists filling the more influential positions do not exert themselves either by pen or word to powerfully promote the art among them. . . . For some years past Mr. H. H. ter Meer has practised what Kerr, his able instructor, had taught him, and with 'extraordinary dexterity' he sews strips of tow side by side upon the sculptured body of the mammal, in such a manner as to exactly imitate the superficial muscles and other parts in the way they occur in nature. Mammals' heads are 'carved out of peat,' and it does not matter out of what substance a mammal is modelled, provided the form is reproduced exactly as it would be were the animal alive, and that it is possible to drive pins in it without bursting or breaking the artificially prepared body, in order to press the skin into the hollows between the muscles. Kerr's methods of imitating the superficial anatomical parts require much patience and time to learn and successfully practise, and this is apt to discourage many young taxidermists at first, as it did Mr. H. H. ter Meer; but its advantages are so great when once accomplished, that no abandoning thereafter is ever entertained by the expert." Mr. ter Meer has also "succeeded in inventing a material, after years of experiment and practice, that possesses the moulding properties of clay, and that dries with great rapidity, and never cracks after once setting." This new material, and what can be accomplished by its use, has received the approval of Sir William Flower, Dr. Bowdler Sharpe, and the artist, J. G. Keulemans, who all visited the Museum to investigate the process. "In terms most unqualified he condemns the methods of mammal mounting practised by Mr. Montagu Browne at the Leicester Museum, and described in his recent work."* Dr. Shufeldt considers he is quite correct in pointing out that it is simply impossible to get the correct form of a large mammal for the purpose of a model by taking casts in plaster "of its lifeless, flayed body."

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* 'Practical Taxidermy,' *vide* 'Zoologist,' 1897, p. 378.

THE importance of understanding the correct attitude of birds in a state of nature cannot be minimised by the taxidermist. Dr. R. W. Shufeldt, in 'Shooting and Fishing' (New York, June 2nd), has given some "Pictures of American Partridges," the result of studies with the photographic camera made on the Texan Bobwhite (*Colinus virginianus texanus*), and the Chestnut-bellied Scaled Partridge (*Callipepla squamata castanogastris*). Referring to the first photograph, Dr. Shufeldt remarks:—"The picture not only shows the correct form and colour distribution of the bird, but in addition thereto one of the very common attitudes it is likely to assume after alighting in a tree." Some interesting notes on the life-history of this bird are given. "William Lloyd, of Marfa, Texas, informed Major Bendire by letter, several years ago, that 'the Texan Bobwhite is a bird of the lowlands, and is not found above an altitude of 2000 feet. Their food consists of small berries, acorns, grain, buds and leaves of aromatic herbs and small shrubs, varied with occasional beetles, grasshoppers, and ants, especially the winged females, of which they seem to be very fond. They are very insuspicious, and their low notes, uttered while feeding, attract a good many enemies. I have seen Foxes on the watch, and the Marsh Harrier perched in a clump of grass on the look-out, waiting for them to pass. But the many large Rattlesnakes found here are their worst enemies. One killed in May had swallowed five of these birds at one meal; another, a female, evidently caught on her nest, and a half-dozen of her eggs; a third, four Bobwhite and a Scaled Partridge. The young are also greatly affected, and many killed by heavy rains in June and July; numbers perish then from cold and protracted wet weather. When alarmed by a Hawk sailing overhead they run under the mother for protection, as domestic chickens do.'"

THE Annual Report of the Royal Zoological Society of Ireland contains many items of considerable zoological interest. The Council has learned by gradual experience that one of the most essential conditions in the construction of a zoological house is to raise both it and the adjoining paddocks high above the level of the surrounding ground, and to provide in this way a ready and sure means of drainage. Damp is much more destructive to animals than cold, and in a perfectly dry house, with dry paddocks, it is often remarkable the amount of cold which animals generally supposed to be delicate will endure without any appreciable effect on their health or spirits.

In the breeding of Lions, the Society has not met this year (1897) with its usual success. Two litters have been born, the first with Hypatia as the mother, consisting of one male and three females, and the second with Portia as the mother, consisting of one male and two females. Unfortunately all these cubs died shortly after birth.

"The Cape Hunting Dogs (*Lycaon pictus*) may now be said to be thoroughly acclimatized. They live all the year round in the most perfect health in an open-air den, and they breed regularly once a year, and apparently always at the same time. The first litter was born on Jan. 6th, 1896; the second litter appeared on Jan. 3rd, 1897, and at the present moment we look forward to the arrival of a third litter. If our calculations are correct, this interesting event should take place at precisely the same period of the year as on the other two occasions. All the cubs of the first litter died. Very special precautions were taken on the occasion of the second birth, but out of a litter of five only one was reared. A foster-mother, in the form of an Irish Terrier, having become available, the temptation to remove some of the puppies and place them under her care proved too strong to be resisted. Accordingly two puppies were selected for this purpose. The following day one of the three puppies left with the mother was found dead in a remote part of the den. Evidently the keeper's hand had touched it, and the mother had in consequence repudiated it, and thrust it out into the cold. This caused alarm for the safety of the remaining two, and it was determined to place a third with the foster-mother. One cub only was left with the mother, but on the next day it had totally disappeared. Evidently the mother had devoured it. Of the three puppies that were placed with the foster-mother, two died, one from natural causes, and the other from an accident. The survivor was difficult to rear, and required constant care on the part of the keepers. In the course of time, however, it gradually grew out of its early weakness, and when five months old it was presented by the Council to the Zoological Society of London. So far as we have been able to learn, this is the first Cape Hunting Dog which has been reared in Europe." During its growth several interesting points were noted. As early as six weeks after its birth it began to show its untractable disposition by snapping at anyone who touched it. When nearly four months old a curious coincidence occurred, which brought out very forcibly the innate savagery of the animal. A small terrier puppy was placed in the same cage, and in a short time the two little dogs became very good friends. Unfortunately, however, in their play the terrier scratched with its sharp teeth the foot of its companion, and the moment the Cape Hunting Puppy saw the blood it attacked its own foot with the greatest fury. Before the keeper could interfere it had torn off a toe and lacerated its foot to a very considerable extent. Fortunately the wound healed well, and in the course of time the animal was very little the worse of its extraordinary attack upon itself.

The Society is still unfavourably handicapped by a paucity of members and consequent narrow income. "The Zoological Society of London receives somewhere about £6000 per annum from members' subscriptions. The Royal Zoological Society of Ireland has received this year from a similar source £394."

THE Eleventh Annual Report of the Liverpool Marine Biology Committee and their Biological Station at Port Erin (Isle of Man), by Prof. W. A. Herdman, is now before us, and it is to be hoped, with the writer of the Report, that a larger and better equipped laboratory at Port Erin or at Hilbre may arise. "Liverpool owes much to the sea; it is asking but little that she should take her place in supporting oceanographic research." A Curator (Mr. H. C. Chadwick) has now been appointed, who will reside at Port Erin; much good and interesting work has been accomplished by visitant naturalists, for "in this age, pre-eminently that of Biology—the age of Darwin, Pasteur, and Lister—it is coming to be recognized equally over Europe and America that nowhere more than in Marine Biological Stations has the work of the great masters been followed up and extended, and that nowhere else can be found a more natural and happy union of the philosophy of science and of industrial applications." The concluding remarks of Prof. Herdman breathe the new biological aspirations:—"As we have recorded, in the earlier part of this Report, science students from our colleges are beginning to attend the Biological Station for purposes of work. That is very satisfactory; but we shall not be content with science students alone. We desire to interest and educate the general public in natural history, and to give all university students opportunities of studying living nature. Students of science study, to some slight extent at least, Arts subjects—Literature, History, Languages, and, it may be, Philosophy; but how very few of the ordinary Arts-students have even the most elementary acquaintance with any experimental or natural science. Fortunately, it is now becoming rare to hear an educated person boasting of ignorance or indifference to science, but it is still very unusual to find anyone who has received a non-scientific education and who understands and appreciates the natural phenomena by which he is surrounded. The elements of nature-knowledge should surely always form part of a liberal education; and a most instructive portion of the course on nature-knowledge would be a couple of weeks spent amongst the researchers at a biological station. It is a revelation and an inspiration to the young student, or the inexperienced, to spend a forenoon on the rocks exploring and collecting with specialists who can point out at every turn the working of cause and effect, adaptation to environment, and the results of Evolution. It is equally instructive and inspiring to have a day at the microscope with, say, our authority on

Copepoda, studying the nature and ways of animals which are probably of greater economic importance to the world than the wheat plains of Manitoba or the gold of Klondike."

THE Annual Report of the Millport Marine Biological Station for 1897 has been issued. As regards the excellence of the position for this young but thriving station, we may quote the words of Sir John Murray, at the opening of the new building in May of last year:—"The station was excellent in many respects, but when all was said it was of very modest pretensions. In respect to accommodation, and to tanks and all appliances which were now necessary for the thorough investigation of the ocean, it did not attempt to compare with many similar institutions in this country, and on the Continent of Europe and in America. Still, it was a place of very great possibilities, and there was one respect in which it was superior to all the stations with which he was acquainted, and that was as regarded its position. Around the islands of Cumbrae they had every variety of sandy beach, of rocky shore, and of muddy bank, each of them with its own peculiar fauna and flora, and the rise and fall of the tide was such that these could be reached with very great facility. The researches of the Rev. Canon Norman, and of Dr. and Mrs. Robertson, had made these shores familiar among naturalists. Within a very few miles of that place, in the direction of Arran, there was a depth of 600 feet, where there were a great many deep-sea animals living quite unlike those found round about the shores. In upper Lochfyne and in Lochgoil there were still the remnants of Arctic fauna and flora, as was long ago pointed out by Mr. Smith, of Jordanhill. In numerous places, where rivers enter into the Clyde sea-basin, there was a great variety of animals which lived in the brackish water, and at the mouth of the firth they found quite a different set of conditions. On one occasion the Duke of Argyll found that the shores around Kintyre were lined with a thick bed of organisms, which showed that sometimes the waters of the Gulf Stream were driven into this area. They had thus within easy reach of the Millport Station a great variety of organisms, and of conditions, a charming and attractive combination which was always desired by the inquiring naturalist."

From the Report of the Curator, Mr. Alex. Turbyne, we learn that it is now twelve years since the 'Ark' was beached in Millport by the then Dr. John Murray, F.R.S., of the 'Challenger' Expedition, and until May last she was, to the zoologist and botanist, the only centre of scientific interest in the Clyde district. Still, during that time she proved an incentive to visits of, amongst others, Prof. Haeckel, the late Prof. Schmidt, and Prof. Agassiz; and this goes to prove—if proof were necessary—that the new station was a necessity, and will be a great gain to marine biology.

The Robertson Museum is also a by no means unimportant part of the Institution. "Mrs. Robertson having kindly handed over to the Committee the collections of her late husband, it was found that the cases fitted up round the walls of the Museum afforded quite inadequate accommodation for all the specimens. A large double case was accordingly added, fitted with forty-eight drawers and trays, to receive the valuable collections of Carboniferous and Glacial Fossils, and these collections will be exhibited to any who are interested in them, besides being at the disposal, for reference, of specialists or others working at the Station."

THE Gatty Marine Laboratory of St. Andrews, directed by Prof. W. C. McIntosh, does not publish Annual Reports, but still continues to effect a great amount of active work. As the Professor writes to us, "Marine zoology proper and the zoology of the fisheries form the chief pursuit." At the end of 1896, however, there was published at Dundee an excellent brochure on the Gatty Marine Laboratory, written by the Director, in which, among other matters, reference to the chief laboratories at present in existence was made. "It is a remarkable fact that whereas about thirty years ago no such institution existed in any country, a chain of them now encircles the world." On the question whether a Marine Laboratory as that of St. Andrews, which sprang into existence for the sake of the fisheries, should be in connection with the University alone, or subsidized by a Public Department, is answered by Prof. McIntosh in favour of the former. "A University Marine Laboratory gives greater freedom in investigation, and the administration is untrammeled by the frequent demand for results as a *quid pro quo* for the public expenditure (which may only cover the original equipment and the attendant); in short, is no longer under the necessity of showing what it has done for the fisheries of the country, and is removed from the intricate network of the political sphere."

St. Andrews as a site for the study of marine animals has a reputation probably as ancient as the foundation of its University—founded in 1411—"for amongst the early records of the latter allusion is made to the marvels of the sea and its inhabitants as a means for improving the minds of its students." The new Marine Laboratory owes its existence to the generosity of Dr. Charles Henry Gatty, who presented the University with a sum of £2500 for that purpose. The number of naturalists who resort to this establishment, and the papers published by the Directors and others connected therewith, bear ample testimony to the great work done at St. Andrews for marine zoology.

THE Jersey Biological Station is, we are surprised to learn, run by purely private enterprise, and that of one man. Mr. James Hornell, its Director, writes us:—"You may not be aware that the work done here is totally without financial support from public or private bodies. I have to keep it going by my work in micro. and lantern departments, and, being without financial backing of any kind, you can imagine how uphill the work is." The official publication is 'The Journal of Marine Zoology and Microscopy,' edited by Mr. Hornell, of which two volumes have now been completed. In the last issue the Editor has contributed a most interesting paper on "The Possibilities of Fishery Improvement in Jersey." The inshore fishermen, such as we have in Jersey, the men who fish in small undecked boats, find their own particular grounds rapidly becoming depopulated, and, unable to seek the more distant fishing-grounds, are compelled either to seek new occupations, or to languish on earnings that are miserably insufficient. Along the French coast a similar evil state of matters exists; thus, my esteemed friend Dr. Canu, Director of the Station Aquicole at Boulogne, and the foremost authority on pisciculture in France, writes:—"In the eastern portion of the English Channel, the majority of the banks formerly frequented on account of the number and the quality of their fish, have long since witnessed the loss of their reputation; they are even partially abandoned." And again:—"The diminution of fish catches on the banks which line our Channel coast can no longer be disputed. . . . The decrease of our small northern fishing ports is more eloquent than any statistics upon this point. So well authenticated and so well recognized by the fishers themselves is this decadence in Jersey, that it requires little or no demonstration from me. Indeed, in view of the absence of local statistics as to catches, it is impossible of verification in figures. However, I have the authority of our best-informed fishermen for stating definitely that a diminution of 30 per cent. to 40 per cent. has been observable in their catches of many of the most important of our local fishes during recent years, such as Sand-eels, Gras-dos (Smelts), Gurnard, Conger, Whiting, Sarde (Red Bream), Flat-fishes, &c., to say nothing of the dead Oyster and Ormer fisheries, or of Black Breams and Lobsters, about which we have statistics, definite and incontrovertible. The decrease which is caused by actual scarcity of the fish themselves is most marked in the catches of the Flat-fishes generally (Plaice, Soles, Turbots, &c.), the Bream, Sand-eels, Gras-dos, and Lobsters; in the case of the larger Round-fishes, such as the Whiting and the Conger, the cause is probably due to the marked decrease in the supply of bait available in Jersey, especially so in the case of the Squids (*Sepia* and *Loligo*), and of the 'red-cat' bait-worms (*Nereis*). Seven or eight years ago Plaice of large size were common in the large bays, measuring some fourteen inches long on the average; to-day such fine fish are extremely rare, and our market depends for its supply upon imports from Plymouth, Lowestoft, and Grimsby. It is significant to notice that the decline in Plaice coincides with the sudden increase in the use of set-nets and draw-nets in our bay that occurred a few years ago."

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